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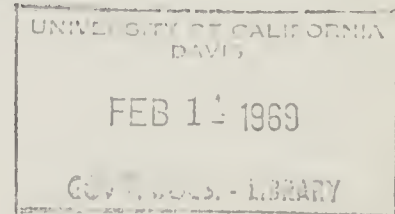
Department of Water Resources

BULLETIN No. 74-6

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Water Well Standards
FRESNO COUNTY

SEPTEMBER 1968



NORMAN B. LIVERMORE, JR.
Secretary for Resources
The Resources Agency

RONALD REAGAN
Governor
State of California

WILLIAM R. GIANELLI
Director
Department of Water Resources

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ABSTRACT

Improper construction and abandonment of water wells is one of the major sources of potential impairment of ground water quality in Fresno County. In August 1967, the county adopted limited control of water well construction and abandonment, administered by the Fresno County Health Department. The Department of Water Resources recommends an ordinance be adopted to control water well construction and abandonment in Fresno in accordance with construction standards presented in Chapter II of DWR Bulletin No. 74, "Water Well Standards - State of California", with consideration to conditions noted in this report, and that a program be initiated to correct existing conditions of improperly constructed and abandoned wells.

FOREWORD

This report is one of a series designed to present to the State regulatory agencies the Department's recommendations for water well standards necessary to preserve the quality of California's ground water resources.

The investigation leading to this report was conducted under authority of Section 231 of the Water Code, State of California. The report, to the Central Valley Regional Water Quality Control Board and to the State Department of Public Health, was prepared under the directive of Section 13800 of the Water Code.

It is recommended that an ordinance be adopted in Fresno County to regulate the construction, alteration, and abandonment of water wells in accordance with the statewide standards presented in Bulletin No. 74, "Water Well Standards - State of California", together with the specific standards presented herein. These standards are designed to provide adequate protection of the ground water without imposing unreasonable hardships on either the property owner or the well driller.

William R. Gianelli
William R. Gianelli, Director
Department of Water Resources
The Resources Agency
State of California
September 18, 1968

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES

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Executive Secretary

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AUTHORIZATION

The Water Well Standards Program under which this report was prepared is authorized by Section 231 of the Water Code, State of California which reads:

"231. The department, either independently or in cooperation with any person or any county, state, federal or other agency, shall investigate and survey conditions of damage to quality of underground waters, which conditions are or may be caused by improperly constructed, abandoned or defective wells through the interconnection of strata or the introduction of surface waters into underground waters. The department shall report to the appropriate regional water quality control board its recommendations for minimum standards of well construction in any particular locality in which it deems regulation necessary to protection of quality of underground water, and shall report to the Legislature from time to time, its recommendations for proper sealing of abandoned wells."

In 1967 the Legislature established a procedure for implementing standards developed under Section 231 by enacting Chapter 323, Statutes of 1967, which added Sections 13800 through 13806 to the Water Code. In Section 13800, the Department of Water Resources' reporting responsibility is enlarged upon:

"13800. The department, after such studies and investigations pursuant to Section 231 as it finds necessary, on determining that water well construction, maintenance, abandonment, and destruction standards are needed in an area to protect the quality of water used or which may be used for any beneficial use, shall so report to the appropriate regional water quality control board and to the State Department of Public Health. The report shall contain such recommended standards for water well construction, maintenance, abandonment, and destruction as, in the department's opinion, are necessary to protect the quality of any affected water."

CHAPTER I. INTRODUCTION

Fresno County's position as the nation's leading agricultural county would be impossible without an abundant ground water resource of acceptable quality. The protection of the existing resource is essential to the preservation of the county's agricultural economy.

The major sources of potential impairment of ground water in Fresno County are improper domestic and industrial waste disposal practices and improper construction and abandonment of water wells. Established requirements regulating waste disposal practices (under the jurisdiction of the Regional Water Quality Control Board) generally protect the receiving waters from degradation. Until recently, there has been no regulation of construction or abandonment of water wells. In August 1967, Fresno County adopted Ordinance No. 524 which exercises limited control. This ordinance is administered by the Fresno County Health Department.

In February 1968, the Department of Water Resources published Bulletin No. 74, "Water Well Standards - State of California", which presents minimum standards for construction and abandonment of water wells for application on a statewide basis. Bulletin No. 74 recognizes that alternative standards may be required in certain areas where unusual conditions exist or where unusual types of wells are to be constructed. Provisions for these variances are included in Chapter II, Part I as Sections 3, 4, and 5 of Bulletin No. 74.

Conclusions

The investigation leading to this report revealed several conditions conducive to ground water quality degradation which would have been prevented by suitable well construction and abandonment standards. Prominent among these conditions are the many agricultural wells which penetrate two or more aquifers and are perforated in all water bearing zones and are gravel packed throughout most of the depth. In most cases the water in the aquifers varies widely in quality and the combined water pumped from this type of well is of a substantially lower quality than would have been produced from a well extracting only from the best quality aquifer. High production wells of this type develop large variations in aquifer pressures. Rapid interaquifer transfer of water and degradation of quality are the end results. The existing Fresno County ordinance does not include standards for regulation of construction of agricultural wells and therefore, it is inadequate to protect existing ground water from this source of degradation.

The current trend of people to migrate to summer residences in the Sierra Nevada recreation areas presents a potential threat to ground water quality. The buildup of relatively high density residential developments in small valleys and on lakeside slopes are of prime concern to the safety of the existing meager ground water supplies.

The high concentration of individual sewage disposal systems within the larger metropolitan areas such as Fresno constitutes a threat to present municipal water supplies.

As a result of this investigation, it was concluded that the standards presented in Bulletin No. 74, "Water Well Standards - State of California", are adequate to protect the quality of ground water in Fresno County. Certain areas require special attention in the application of the standards, however, and these areas are discussed in more detail in Chapter II.

Recommendations

In accordance with the provisions of Section 13800 of the Water Code, the Department of Water Resources recommends to the Central Valley Regional Water Quality Control Board and to the Department of Public Health that:

1. Water well standards be established in Fresno County.
2. The standards presented in Chapter II of Department of Water Resources Bulletin No. 74, February 1968, together with the specific standards presented in this report on page 7 form the basis for these standards. The administering agency should give special consideration to conditions discussed in Chapter II of this report and summarized in Table 1 in the application of these standards.
3. A program be initiated to correct existing conditions of improperly constructed and abandoned wells.
4. The implementing agency utilize all available data and services of other public agencies in the application and policing of the standards.

Standards

The variety of subsurface conditions in Fresno County necessitates the division of the county into four areas (see Figure 1) for the purposes of this discussion. In general, the standards presented in Chapter II of Bulletin No. 74 are considered adequate for the protection of the existing ground water resource in each of these areas. Because of certain conditions which exist in parts of Fresno County, however, some of the standards must be more explicit than as presented in Bulletin No. 74. In other areas, it is imperative that well drillers and well owners have knowledge of existing unusual conditions and that reasonable precautions are taken to assure the protection of the resource.

The following are additional standards, more explicit statements of certain standards contained in Bulletin No. 74, and special precautions which must be taken in the design and construction of water wells in Fresno County.

TABLE 1

SPECIAL CONSIDERATIONS FOR WATER WELL CONSTRUCTION, FRESNO COUNTY

Area*	Potential Water Quality Impairment	Special Considerations
I	Local flooding Waste disposal facilities	Positive sanitary surface seal Proper location of well
II	Domestic and industrial waste disposal facilities	Proper location of well and positioning of perforations
III	Accumulation of minerals Oil field waste disposal Deep subsidence	Positioning of perforations to exclude high-mineral-content waters and to pre- vent interaquifer transfer of waters Location of well and positioning of perforations to exclude oil field polluted waters Provisions for subsidence in position- ing perforations, gravel pack, and seals to prevent interaquifer transfer
IV	Oil field waste disposal	Location of well and perforations to exclude oil field polluted waters

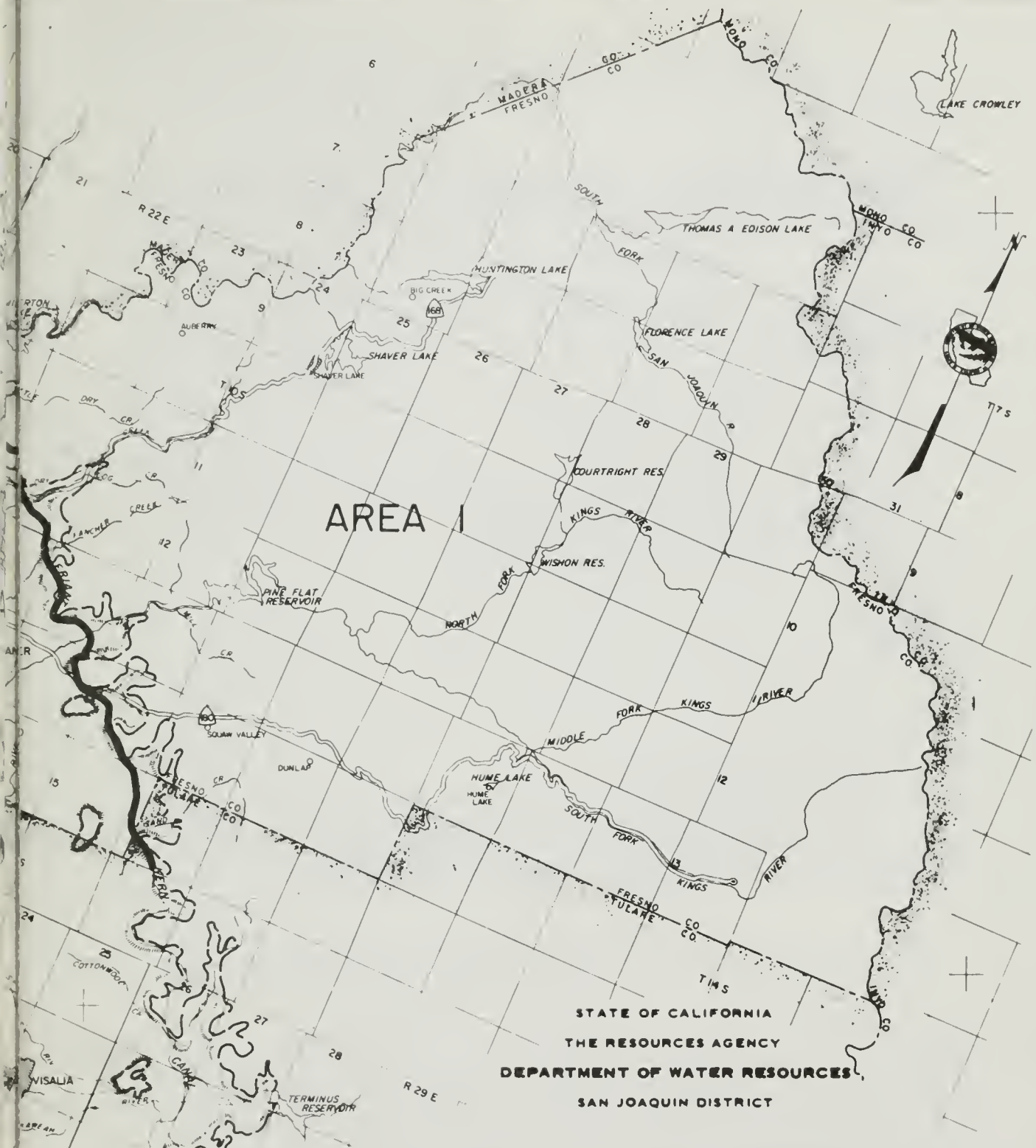
*See Figure 1

Area I, Eastern Mountain Area. In compliance with Sections 8 and 9 precautions will be taken to assure against contamination of the water supply by existing and proposed waste disposal facilities and by localized flooding.

Area III, Valley Trough. Section 13 requires that interaquifer transfer of waters be prevented if the transfer would cause significant deterioration of the quality of water in another aquifer. Compliance with this standard in Area III requires that:

1. Wells will not be perforated both above and below the Corcoran Clay (Figure 2);
2. Gravel packing will not extend through the Corcoran Clay;
and
3. A positive seal at least 20 feet deep extending down from the top of Corcoran Clay will be provided in the annular space of each well penetrating the Corcoran Clay.

In addition to the provisions of Section 13, the following standards will also apply:



WATER WELL STANDARDS-FRESNO COUNTY

AREA INVESTIGATION

SCALE OF MILES



1. Perched waters, including those retained on the A Clay (Figure 3) will be excluded from all wells unless said well is drilled expressly for the extraction of perched waters for ground water level control.

2. Wells drilled for extraction of perched waters for ground water level control will not penetrate any existing usable ground water body lying below the perched water.

3. A positive seal of a depth of at least 20 feet or at least the thickness of the A Clay, whichever is the least, will be provided in the annular space of each well penetrating the A Clay.

4. Wells drilled in the area of deep subsidence (Figure 3) will have included in their design provisions which will (a) assure the integrity of all seals in the event of deep subsidence, and (b) prevent interaquifer transfer of waters in the event of casing collapse resulting from deep subsidence. Such provisions could include, but are not limited to, a weak point in the casing for control of collapse or a slip joint in the casing to allow for vertical movement without casing collapse.

Objectives

The objectives of the Department's Water Well Standards Program are to:

1. Determine areas where water well construction standards are necessary to protect ground water.

2. Determine the ability of standards published in Bulletin No. 74, "Water Well Standards - State of California", to protect the existing ground water resources from degradation, and, if necessary, develop additional or more stringent standards.

3. Report the need for such standards to the appropriate regional water quality control board and to the State Department of Public Health.

Scope

Ground water quality, hydrology, geology, and well construction data from throughout Fresno County were reviewed. In areas where available data were inadequate, additional data were collected. Known cases of ground water pollution and degradation were studied to determine if proposed well construction standards would have prevented the pollution or degradation.

Abandoned and operating wells throughout the County were surveyed to determine surface sealing and well abandonment practices and conditions of potential degradation.

CHAPTER II. GROUND WATER CONDITIONS

Fresno County presents a variety of topography typical of the San Joaquin Valley. Precipitation on the Sierra Nevada is the origin of ground water supplies used extensively on the valley floor. The valley floor has the appearance of a reclaimed desert. The western edge of Fresno County consists of rolling barren hills.

The subsurface geology of Fresno County is as varied as the topography. For this reason, the county has been divided into four areas: Area I, the Eastern Mountain Area; Area II, the Valley-Floor-East Side; Area III, the Valley Trough; and Area IV, the Western Mountain Area (see Figure 1).

Area I, Eastern Mountain Area

The Eastern Mountain Area of Fresno County consists of the western slopes of the Sierra Nevada comprising the watershed between the San Joaquin and Kings Rivers East of the Friant-Kern Canal. Ground water is stored in the relatively shallow decomposed rock and fractured bedrock underlying the soil mantle. The clear flow channels and large pore size of the water-bearing fractured bedrock facilitate rapid movement of ground water. Ground water supplies are usually very limited and vary directly with the amount of annual precipitation.

Ground water quality problems in this area of Fresno County are usually associated with frequent localized flooding and sewage disposal practices in the rapidly urbanizing recreation areas of the mountains. An investigation of ground water quality conditions in the Huntington and Shaver Lakes areas revealed nitrate concentrations as high as 24 mg/l (milligrams per liter). The occurrence of nitrates in this area is attributed to waste water from individual sewage disposal facilities.

Area II, Valley Floor-East Side

The Valley Floor-East Side area consists of that portion of Fresno County between the Friant-Kern Canal and the eastern edge of the Corcoran Clay as shown on Figure 1. Ground water occurs in the unconsolidated sediments deposited by streams emerging from the Sierra Nevada. The aquifer is up to 2,000 feet thick and is unconfined or semiconfined.

Water quality problems in Area II are generally associated with the metropolitan and industrial character of the area. Several problems that were investigated in the past have been corrected by changes in waste disposal practices.

High nitrate concentrations in the vicinity of the Fresno-Clovis Metropolitan area remain a potential hazard to existing and new wells in the area. This problem was reported in Bulletin No. 143-3,

"Fresno-Clovis Metropolitan Area Water Quality Investigation" (April 1965). The Fresno County Health Department is continuing to monitor ground water quality in the metropolitan area.

Area III, Valley Trough

The Valley Trough Area consists of that portion of the valley floor which is underlain by the Corcoran Clay, as shown on Figure 2. The ground water basin in this area is divided into three aquifers; a confined aquifer below the Corcoran Clay, an unconfined aquifer above the Corcoran Clay, and a perched aquifer. Ground water quality problems in this area are associated with agricultural activities and oil field waste disposal.

Water quality is more variable in this area than in any other area of the County. This variability in quality precludes any specific statements regarding ground water quality in this area. Two general statements, however, can be made:

1. The concentration of dissolved minerals is higher in the waters of the perched and unconfined aquifers than in the confined aquifer.

2. The concentration of dissolved minerals in the waters of all three aquifers increase from the eastern edge of the area to the western edge.

The first point is illustrated by a comparison of mineral analyses of ground water samples collected from four wells at one location near the trough of the valley (T15S/R14E-15). The electrical conductivity of water in these wells in the depth interval 0-280 feet, 300-460 feet, 480-700 feet, and 720-800 feet (below the Corcoran Clay) was 4,100, 1,600, 1,900, and 1,100 micromhos, respectively.

The second point is illustrated by a comparison of analyses of water from eight wells near the eastern edge of the area, where the electrical conductivity averaged 515 micromhos, with the analyses of ground water from five west side wells perforated in the upper aquifer, where the conductivity averaged 3,132 micromhos, and with six wells perforated in the confined aquifer, where the conductivity averaged 1,673 micromhos. Waters with electrical conductivity as high as 45,000 micromhos have been found perched on a shallow clay lens in the valley trough. This clay layer, known as the "A Clay", is delineated on Figure 3.

In this area many wells have been constructed for maximum production by using gravel packing throughout the depth and perforating in all water bearing intervals. This type of construction disregards differences in the quality of the aquifer and the effect of interaquifer transfer of waters. Wells of this type form a physical connection between aquifers and eliminates the beneficial effects of any separating media such as the Corcoran Clay.

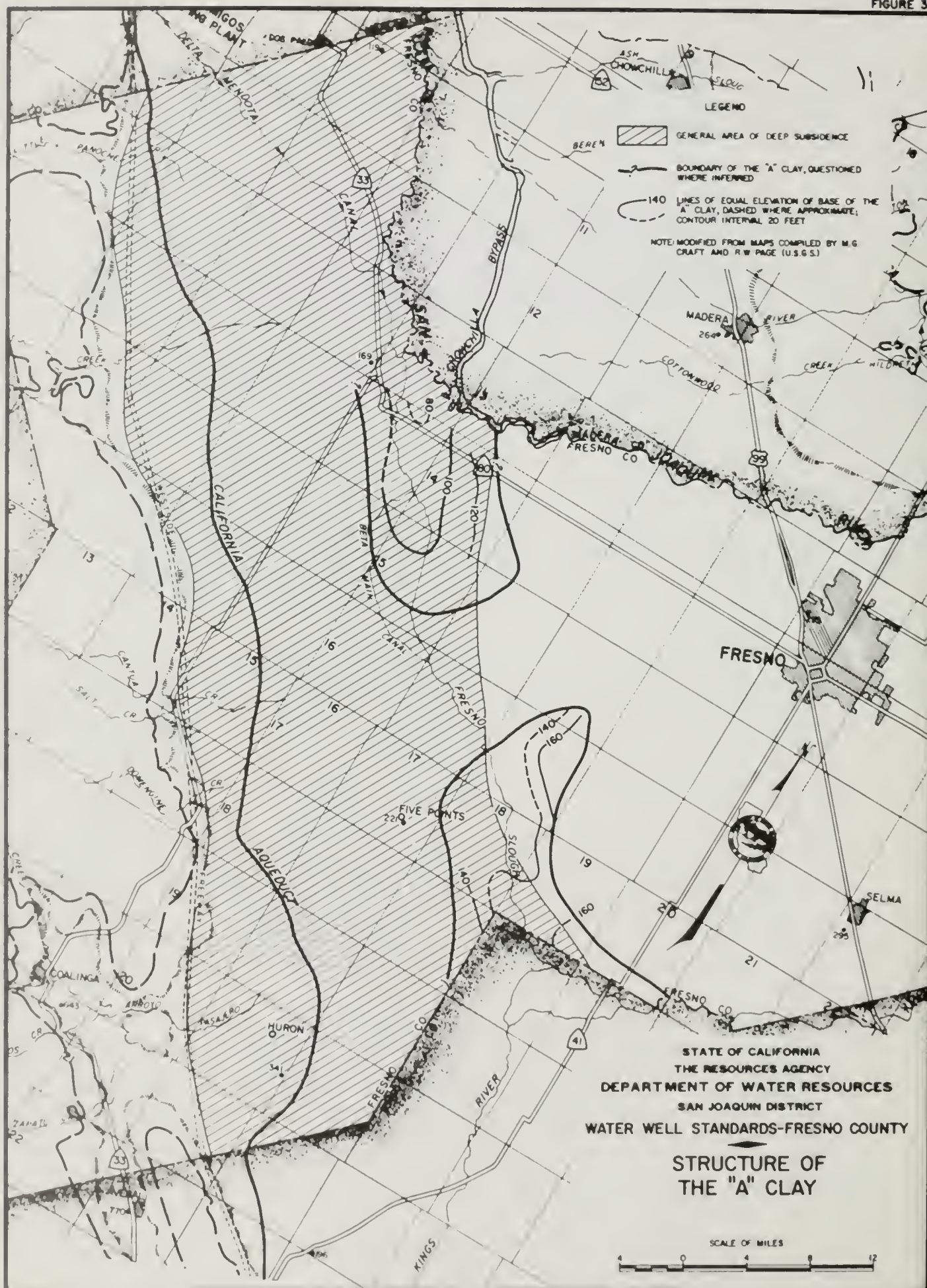
Deep subsidence west of the valley trough (Figure 3) has resulted in the destruction of wells through casing collapse. This subsidence is the result of ground water extraction from the confined aquifer and the subsequent reduction in pressure and compaction of sediments.

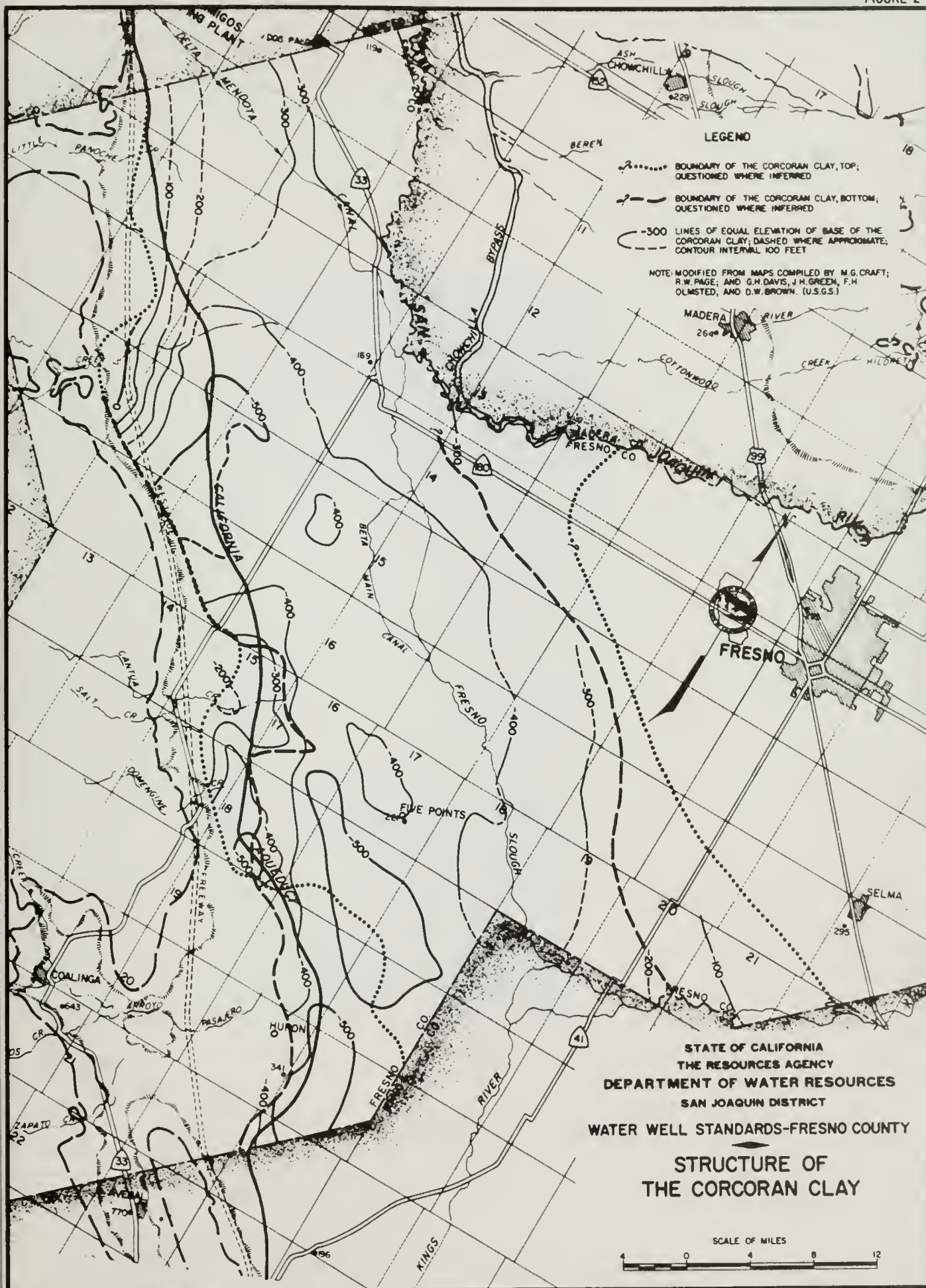
Area IV, Western Mountain Area

The Western Mountain Area consists of the eastern slopes of the Coastal Range. With the exception of Pleasant Valley, little use is made of ground water in Area IV. Most ground water is highly mineralized and consequently is not suitable for most uses.

Ground water in Pleasant Valley is used for irrigation of alfalfa and other salt tolerant crops in spite of its high mineral content. The City of Coalinga has installed demineralizers for production of a more suitable drinking water.

Water quality problems in Pleasant Valley, other than naturally occurring high mineral content, are generally associated with oil field waste disposal practices. Restrictions have been imposed on the disposal of wastes from oil field activities to prevent further degradation of available ground water supplies. Localized areas of abnormally high mineral concentrations may be encountered in areas of abandoned waste disposal sumps.





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